

REMARKS

Reconsideration and allowance of this application, as amended is respectfully requested.

This Amendment is in response to the Office Action dated April 18, 2006. By the present Amendment, the title has been amended to respond to the requirement for such an Amendment set forth in the Office Action. Also, claim 5 has been amended to respond to the objection set forth in the Office Action. Accordingly, reconsideration and removal of the objections to the title and claim 5 set forth in the Office Action is respectfully requested.

Briefly, the present invention is directed to an improved memory controller for providing more efficient access to banks or pages of a DRAM than has been previously possible. As discussed in the background of the invention starting on page 1, DRAMs have recently come to be very frequently used as the main memory for personal computers. As a result, more efficient memory access for such DRAMs has been necessary, and a variety of techniques are discussed in the background of the invention for improving efficiency. Notwithstanding this, the process of memory access is still slower in prior art devices than is desirable. Accordingly, the present invention is directed to providing further increases in the memory access efficiency.

To this end, as set forth on page 9, line 10 et seq, the memory controller of the present invention operates such that, after activation of a first page to be accessed and before the accessing of the activated page, "the bank or the page to be accessed next or subsequently is precharged in advanced." As a result, as noted on page 9, line 14 et seq:

When accessing the bank or the page to be accessed next or subsequently, therefore, the particular bank or the page, as the case may be, is not required to be precharged and can be accessed by the read or write operation after activation with

precharge. Even in the case where a different page is accessed due to a page mishit, therefore, the time is saved after precharge to activation. Thus, the time overhead can be shortened and an efficient access can be achieved. As a result, the data amount accessible per unit time can be increased thereby contributing to an improved band width.

Reconsideration and allowance of claims 1-5 over the rejection based on USP 5,732,236 to Nguyen, is respectfully requested. With regard to this, it is noted that, in each case, the independent claims clearly define the feature of the present invention that a page which is to be subsequently accessed is precharged prior to an access request for that page. For example, referring to claim 1, the claim specifically defines that the memory control means executes:

“before a next request for access to a page to be accessed subsequently by said processor, precharge of said page to be subsequently accessed.”

Each of the independent claims 2-4 defines this same feature.

Although the primary reference to Nguyen is of general interest regarding precharging of pages according to an improved precharge schedule, an important difference between the present claimed invention and the Nguyen reference is that Nguyen activates the precharge for a subsequently accessed page only after receiving the next access request (rather than prior to the next access request, as set forth in the present claims). This is clear, for example, from column 1, lines 32-60, and column 7, line 45 through column 8, line 20. In particular, column 1, line 37, et seq, discusses the prior art interleaving technique, which is also discussed in the background of the invention of the present application. Although interleaving certainly has been a useful technique in the past, as recognized both by the Nguyen reference and the present invention, this technique does not achieve the efficiency which is desired.

In column 7, lines 45 through column 8, line 20, the precharging and accessing arrangement shown in Fig. 3B is discussed. As set forth in this portion of Nguyen, a page which is to be subsequently accessed is precharged while a first page is presently being accessed. Although this does improve efficiency, it requires the next access request to be received before precharging of the next accessed circuit begins. Accordingly, it is respectfully submitted that Nguyen fails to teach or suggest the features defined by all of the present claims that the precharge of a page to be accessed subsequently is executed before a next request for access to that page takes place. Accordingly, reconsideration and allowance of the presently pending claims 1-5 is earnestly solicited.

If the Examiner determines that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 500.40687CX1).

Respectfully submitted,
ANTONELLI, TERRY, STOUT & KRAUS, LLP.



Gregory E. Montone
Registration No. 28,141

GEM/vvr
1300 N. Seventeenth Street
Suite 1800
Arlington, Virginia 22209
Tel: 703-312-6600
Fax: 703-312-6666

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